

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, comprising the steps of:  
forming a crystalline semiconductor film containing a metal element over a  
5 transparent substrate;  
irradiating with a first laser beam to the crystalline semiconductor film in a  
direction from the crystalline semiconductor film to the substrate after forming the  
crystalline semiconductor film; and  
irradiating with a second laser beam to the crystalline semiconductor film  
10 through the substrate in a direction from the substrate to the crystalline semiconductor  
film after irradiating with the first laser beam.
2. A method of manufacturing a semiconductor device according to claim 1,  
wherein the first laser beam is a pulsed laser beam having a wavelength range from a  
15 visible region to a vacuum ultraviolet region, and the second laser beam is a pulsed or  
continuous wave laser beam having a wavelength range from a visible region to a vacuum  
ultraviolet region.
3. A method of manufacturing a semiconductor device according to claim 1,  
20 wherein each of the first and second laser beams is emitted from a laser selected from the  
group consisting of a gas laser, a solid-state laser, and a metal laser.
4. A method of manufacturing a semiconductor device according to claim 1,  
wherein the first laser beam is emitted from a laser selected from the group consisting of  
25 an excimer laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a  
copper vapor laser, and a gold vapor laser.
5. A method of manufacturing a semiconductor device according to claim 4,  
wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a  
30 KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.
6. A method of manufacturing a semiconductor device according to claim 1,

wherein the first laser beam is emitted from a laser selected from the group consisting of second, third, or fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

7. A method of manufacturing a semiconductor device according to claim 1,  
5 wherein the second laser beam is emitted from a laser selected from the group consisting of an excimer laser, an Ar laser, a Kr laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a He-Cd laser, a copper vapor laser, and a gold vapor laser.

8. A method of manufacturing a semiconductor device according to claim 7,  
10 wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

9. A method of manufacturing a semiconductor device according to claim 1,  
15 wherein the second laser beam is emitted from a laser selected from the group consisting of second, third, and fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

10. A method of manufacturing a semiconductor device, comprising the steps of:

forming an amorphous semiconductor film over a transparent substrate;  
20 adding a metal element to the amorphous semiconductor film followed by heating thereby forming a crystalline semiconductor film after forming the amorphous semiconductor film;

irradiating with a first laser beam to the crystalline semiconductor film in a direction from the crystalline semiconductor film to the substrate, thereby melting and  
25 crystallizing the crystalline semiconductor film after adding the metal element; and

irradiating with a second laser beam to the crystalline semiconductor film through the substrate in a direction from the substrate to the crystalline semiconductor film, thereby melting and crystallizing the crystalline semiconductor film after irradiating with the first laser beam.

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11. A method of manufacturing a semiconductor device according to claim 10, wherein the first laser beam is a pulsed laser beam having a wavelength range from a

visible region to a vacuum ultraviolet region, and the second laser beam is a pulsed or continuous wave laser beam having a wavelength range from a visible region to a vacuum ultraviolet region.

5           12. A method of manufacturing a semiconductor device according to claim 10, wherein each of the first and second laser beams is emitted from a laser selected from the group consisting of a gas laser, a solid-state laser, and a metal laser.

10           13. A method of manufacturing a semiconductor device according to claim 10, wherein the first laser beam is emitted from a laser selected from the group consisting of an excimer laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a copper vapor laser, and a gold vapor laser.

15           14. A method of manufacturing a semiconductor device according to claim 13, wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

20           15. A method of manufacturing a semiconductor device according to claim 10, wherein the first laser beam is emitted from a laser selected from the group consisting of second, third, or fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

25           16. A method of manufacturing a semiconductor device according to claim 10, wherein the second laser beam is emitted from a laser selected from the group consisting of an excimer laser, an Ar laser, a Kr laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a He-Cd laser, a copper vapor laser, and a gold vapor laser.

30           17. A method of manufacturing a semiconductor device according to claim 16, wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

          18. A method of manufacturing a semiconductor device according to claim 10, wherein the second laser beam is emitted from a laser selected from the group consisting

of second, third, or fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

19. A method of manufacturing a semiconductor device, comprising the steps of:

5 forming an amorphous semiconductor film over a transparent substrate;  
adding a metal element to the amorphous semiconductor film followed by heating thereby forming a crystalline semiconductor film after forming the amorphous semiconductor film;

10 irradiating with a first laser beam to the crystalline semiconductor film in a direction from the crystalline semiconductor film to the substrate, thereby melting and crystallizing the crystalline semiconductor film after adding the metal element; and

irradiating with a second laser beam to the crystalline semiconductor film through the substrate in a direction from the substrate to the crystalline semiconductor film, thereby reducing defects in the crystalline semiconductor film after irradiating with  
15 the first laser beam.

20. A method of manufacturing a semiconductor device according to claim 19, wherein the first laser beam is a pulsed laser beam having a wavelength range from a visible region to a vacuum ultraviolet region, and the second laser beam is a pulsed or  
20 continuous wave laser beam having a wavelength range from a visible region to a vacuum ultraviolet region.

21. A method of manufacturing a semiconductor device according to claim 19, wherein each of the first and second laser beams is emitted from a laser selected from the  
25 group consisting of a gas laser, a solid-state laser, and a metal laser.

22. A method of manufacturing a semiconductor device according to claim 19, wherein the first laser beam is emitted from a laser selected from the group consisting of an excimer laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a  
30 copper vapor laser, and a gold vapor laser.

23. A method of manufacturing a semiconductor device according to claim 22,

wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

24. A method of manufacturing a semiconductor device according to claim 19, wherein the first laser beam is emitted from a laser selected from the group consisting of second, third, or fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

25. A method of manufacturing a semiconductor device according to claim 19, wherein the second laser beam is emitted from a laser selected from the group consisting of an excimer laser, an Ar laser, a Kr laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a He-Cd laser, a copper vapor laser, and a gold vapor laser.

26. A method of manufacturing a semiconductor device according to claim 25, wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

27. A method of manufacturing a semiconductor device according to claim 19, wherein the second laser beam is emitted from a laser selected from the group consisting of second, third, and fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

28. A method of manufacturing a semiconductor device, comprising the steps of:

forming an amorphous semiconductor film over a transparent substrate;

adding a metal element to the amorphous semiconductor film followed by heating thereby forming a crystalline semiconductor film after forming the amorphous semiconductor film;

irradiating with a first laser beam to the crystalline semiconductor film in a direction from the crystalline semiconductor film to the substrate after adding the metal element; and

irradiating with a second laser beam to the crystalline semiconductor film through the substrate in a direction from the substrate to the crystalline semiconductor firm after irradiating with the first laser beam.

29. A method of manufacturing a semiconductor device according to claim 28, wherein the first laser beam is a pulsed laser beam having a wavelength range from a visible region to a vacuum ultraviolet region, and the second laser beam is a pulsed or continuous wave laser beam having a wavelength range from a visible region to a vacuum ultraviolet region.

30. A method of manufacturing a semiconductor device according to claim 28, wherein each of the first and second laser beams is emitted from a laser selected from the group consisting of a gas laser, a solid-state laser, and a metal laser.

31. A method of manufacturing a semiconductor device according to claim 28, wherein the first laser beam is emitted from a laser selected from the group consisting of an excimer laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a copper vapor laser, and a gold vapor laser.

32. A method of manufacturing a semiconductor device according to claim 31, wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

33. A method of manufacturing a semiconductor device according to claim 28, wherein the first laser beam is emitted from a laser selected from the group consisting of second, third, and fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

34. A method of manufacturing a semiconductor device according to claim 28, wherein the second laser beam is emitted from a laser selected from the group consisting of an excimer laser, an Ar laser, a Kr laser, a glass laser, a ruby laser, an alexandrite laser, a Ti: sapphire laser, a He-Cd laser, a copper vapor laser, and a gold vapor laser.

35. A method of manufacturing a semiconductor device according to claim 34, wherein the excimer laser is selected from the group consisting of a XeCl excimer laser, a KrCl excimer laser, an ArF excimer laser, a KrF excimer laser, and a XeF excimer laser.

36. A method of manufacturing a semiconductor device according to claim 28, wherein the second laser beam is emitted from a laser selected from the group consisting of second, third, and fourth harmonics of a YAG laser, a YVO<sub>4</sub> laser, and a YLF laser.

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